

Session 2.2 Hydrogen Costs and Key Infrastructure Challenges

CARB Zero-Emission Bus Technology
Showcase and Symposium
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CTE

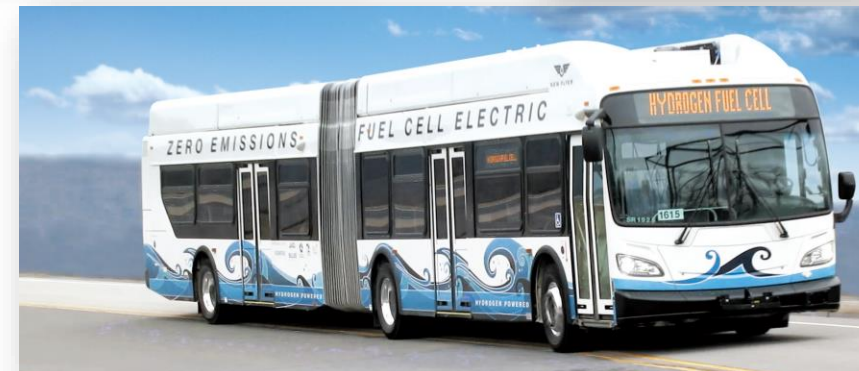
31,401 Hours

AC Transit Fuel Cell Bus Performance - 1/19/2019

Bus	FUEL CELL HOURS	DEC Miles @ 9 MPH	Vehicle Miles Life to Date
FC4	24,560	3,070	231,262
FC5	24,794	4,105	233,068
FC6	24,519	3,516	195,870
FC7	31,401	2,879	215,755
FC8	23,405	583	164,567
FC9	23,904	3,730	204,675
FC10	26,519	3,657	238,456
FC11	27,154	3,741	235,138
FC12*	2,732	2,674	224,202
FC13	16,255	3,654	158,007
FC14	27,603	2,882	232,336
FC15	22,650	2,597	191,307
FC16	27,318	2,284	216,121
TOTALS	302,814	39,372	2,740,764
Average	23,485	3,029	210,828

NOTE: FC7 and FC12 fuel cells were manufactured by UTC in 2003, 14 years ago with an expected EOL of 5,000 hours. The other 11 fuel cells were manufactured by UTC in 2008 and 2009.

*Fuel Cell Changed on FC12 11/21/18 with 25,969 hrs logged.



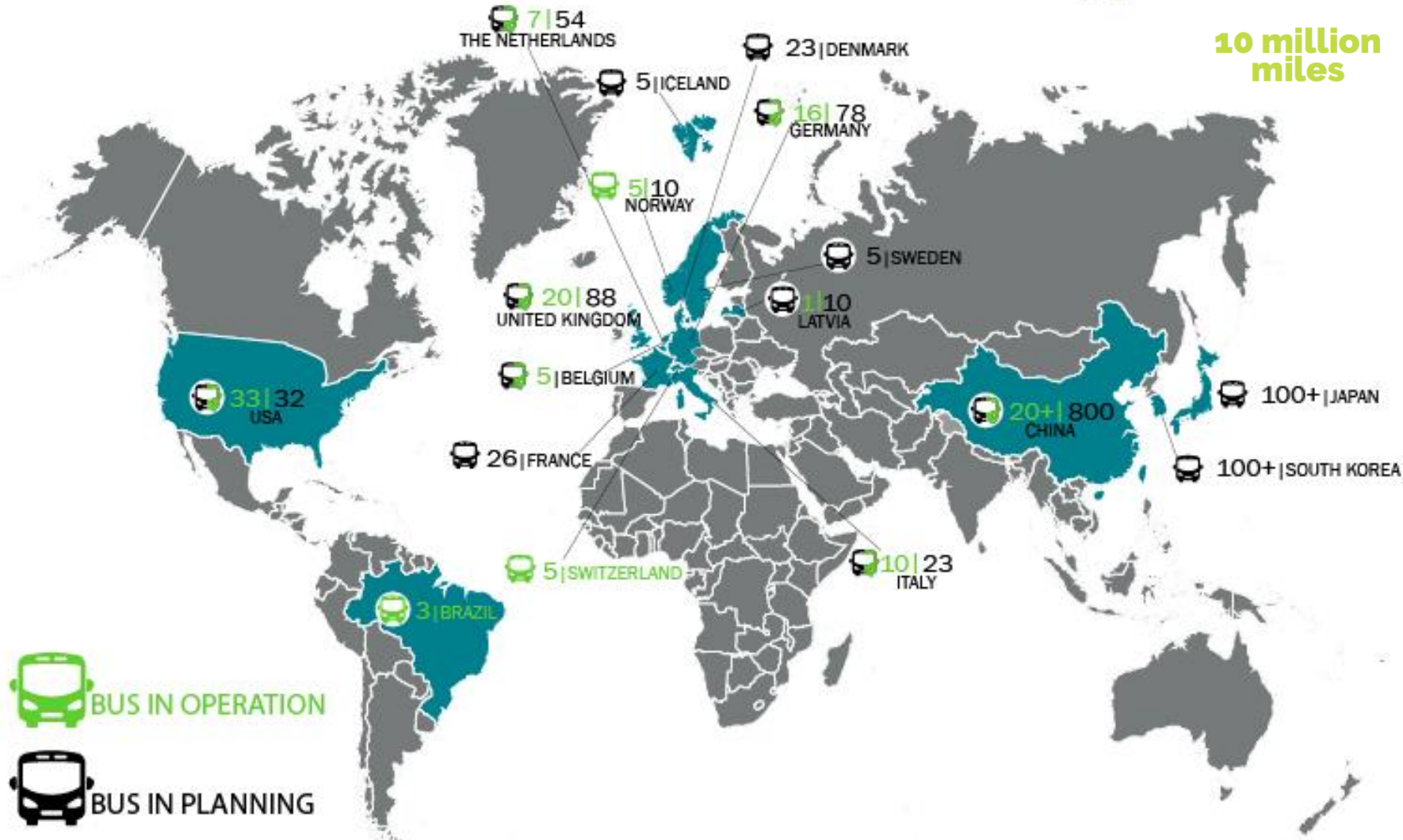
Worldwide Acceptance

FUEL CELL BUSES WORLDWIDE

 **125** | **1100+**

**10 million
miles**

Over 10 million miles of proven service worldwide; 3 million miles at AC Transit and over 1 million at SunLine Transit.



H₂ Infrastructure Challenges

PARSE

- P** **Price** and delivery of H₂ on parity with conventional fuels.
Also equipment maintenance cost reduction.
- A** **Area** of fueling footprint to refuel 50, 100, or 200 buses.
- R** **Renewables** for hydrogen production; **Resiliency** - Natural Disasters;
Also **Redundancy** to ensure near 100% service reliability.
- S** **Speed** of refueling in the normal five- to seven-hour night window;
Also **Scalability** for future expansion.
- E** **Equity**, or CapEX, needed to build at a reasonable price utilizing
baseline components for future scale up.

Panel Participants



Pierre-Germain “PG” Marlier, Business Development Manager, Hydrogen Supply Chain



Chris Kretz, Business Development Manager, Hydrogen Energy Systems



Arnab Chatterjee, Manager Business Development, New Fuels



Ryan Erickson, GM Strategic Development